DOCUMENT RESUME

ED 417 962 SE 061 272

TITLE	CONNECTIONS: An Interdisciplinary Team Approach to Professional Development. Middle School Team.
INSTITUTION	Council for Citizenship Education, Troy, NY.
SPONS AGENCY	Fund for the Improvement of Postsecondary Education (ED), Washington, DC.
PUB DATE	1997-00-00
NOTE	50p.; For related documents, see SE 061 271-73.
AVAILABLE FROM	Council for Citizenship Education, The Sage Colleges, 45 Ferry Street, Troy, NY 12180; phone: 518-244-2363.
PUB TYPE	Guides - Non-Classroom (055) -- Reports - Descriptive (141)
EDRS PRICE	MF01/PC02 Plus Postage.
DESCRIPTORS	Academic Standards; *Citizenship Education; Curriculum Development; Educational Change; Elementary Secondary Education; Hands on Science; *Interdisciplinary Approach; Learning Activities; *Middle Schools; *Partnerships in Education; *Professional Development; Student Evaluation
IDENTIFIERS	New York

ABSTRACT

This report presents the results of a three-year educational partnership that supports a unique interdisciplinary team approach to professional development. The Sage Colleges collaborated with two school districts (City School District of Albany and Niskayuna Central School District) to enable educators to align content and standards; draw upon a bank of assessment vehicles, questions, and assignments; create classrooms in which students are able to make content connections across the curriculum; and develop an interdisciplinary pool of educators capable of addressing the future needs of standards-based professional development. The elementary, middle, and high school teams achieved this outcome through different experiences. This report focuses on the experiences of the middle school team in mapping their curricula, developing connected classroom projects, and creating generic assessment tools and rubrics. Appendices contain curriculum maps, eighth and seventh grade projects, and generic assessment tools and rubrics. (DDR)

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CONNECTIONS

An Interdisciplinary Team Approach to Professional Development

Middle School Team

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CONNECTIONS: An Interdisciplinary Team Approach to Professional Development

Middle School Team

A Partnership of

City School District of Albany
Niskayuna Central School District
The Sage Colleges

COUNCIL FOR CITIZENSHIP EDUCATION
Troy, New York

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The CONNECTIONS project was made possible by a grant from the Fund for the Improvement of Education (FIE) of the U. S. Department of Education. The opinions expressed do not necessarily reflect the positions or policies of the funding agency.

Also available:

CONNECTIONS: An Interdisciplinary Team Approach to Professional Development, Elementary Team

CONNECTIONS: An Interdisciplinary Team Approach to Professional Development, High School Team

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Preface

Recent years have witnessed serious efforts by national organizations, state education departments, and local school districts to restructure education from within the classroom by developing new standards for what students learn and how teachers teach. Every so often, this process must occur if classroom knowledge and behavior is to adapt to new ideas, information, and expectations arising out of the content disciplines, the field of education, and civil society.

Today is one of those times. However, if actual change is to occur in the classroom, there are two teacher needs that must be met: (1) teachers need to see concrete examples that demonstrate the desired focus of the standards; and (2) teachers need opportunities to translate standards into classroom use. We believe that these two needs *of* teachers can be met *by* teachers working together in interdisciplinary teams focused on the development of model assessment vehicles as a means of aligning content standards with both curriculum and instruction. This premise serves as the foundation for our project called, CONNECTIONS.

In 1994, the CONNECTIONS Project began as a three-year partnership with the City School District of Albany, Niskayuna School District, and The Sage Colleges. The project embodies a unique interdisciplinary team approach to professional development. Three teams were established from the outset—Elementary, Middle School, and High School—with educators from each partner institution represented on each team. The teams sought to achieve the following four outcomes: (1) educators who are able to align content and standards; (2) colleagues who are able to draw upon a bank of assessment vehicles and questions/assignments; (3) classrooms in which students are able to make content connections across the curriculum; and (4) districts which gain an interdisciplinary pool of educators capable of addressing future needs of standards-based professional development.

Each team achieved those outcomes in their own way and with different experiences. The following pages detail the experiences of the Middle School Team in mapping their curriculums, developing connected classroom projects, and creating generic assessment tools and rubrics. The team members also provide an evaluation of their experience with the project by asking themselves the question, How has my teaching changed as a result of CONNECTIONS? The responses to this question and the results of their work are exciting and even surprising in some instances.

One final note on the participants and this publication. The preceding list of participants includes all individuals who have been involved throughout all or part of the three years of the project along with those who served as coordinators and staff. This final publication describes the work of all three years of the project; however, only those listed as participants through 1997 and identified by an asterisk assisted in the writing of this publication. The information included on the following pages therefore reflects the status of the Middle School Team's work as of the end of the third year of the project. However, this is not an end to the exciting work initiated during the grant period. The classroom projects and assessment vehicles described herein continue to be refined and improved and will be utilized by team members and their colleagues for years to come.

CONNECTIONS Middle School Team

Introduction

For three years middle school teachers and teacher trainers from the City School District of Albany and Niskayuna Central School District joined with students and faculty from The Sage Colleges to form the Middle School CONNECTIONS Team. Our goal was to design a process and products that represent a connected curriculum. In the narratives and appendices that follow, we show how the choices we made impacted our team history, curriculum mapping, and project design, as well as assessment development and use. We also include an evaluation of the impact the three years had on our schools, our teaching, and teacher training for the future.

Team History and Process

The creation of a connected curriculum is a massive task. Traditional interdisciplinary curriculum development links subject areas by content topics. For our task, we instead sought to identify an essential question and cross-cutting themes that would drive development of a connected curriculum. The essential question was *"How do the choices we make expand or limit our boundaries?"* Our cross-cutting themes were *communication, energy, environment,* and *exploration*. As we reflect over the three-year history as the Middle School CONNECTIONS Team, we realize our work centered around this essential question and its corollary themes. So too did our proces. We made choices and decisions as a collective group that impacted our process, progress, and products.

How did the CONNECTIONS project demonstrate that faculty development can be a factor in a school's growth?

Traditionally, large curriculum development projects and their implementation occur at the administrative level. This project afforded us the opportunity to show that teams of teachers can make true change themselves. This change goes beyond curricular change; it can break down the barriers that subject matter imposes on teachers. Projects such as these force us to think differently about our schools. It gave us, as a faculty, a commitment to the concept of developing a connected curriculum.

We put this concept into practice by developing curriculum maps, connected projects, and assessments. Development of these elements accelerated the natural link between Science and Technology at the eighth grade level especially through the creation of interdisciplinary connections around our essential question. However, the projects we created centered not only on those areas which are traditionally connected such as Science and Technology or Social Studies and English, but fields of study that may not seem natural fits when focusing solely on content. As an example, the essential question led us to link Science with Social Studies and English. The essential question produced outcomes that were not subject specific.

We found that significant faculty development occurs over a sustained period of time with the same group of people working together in close contact. Change can begin with a small group of faculty educators. True change must go beyond curriculum modification.

How did we use the essential question and cross-cutting themes?

The essential question and cross-cutting themes provided students with a sense of the connections that lay ahead. The question and themes also established a consistent message for all students in each of the subject areas where the project was implemented. The essential question and interdisciplinary theme of *exploration* involved our team and provided the vehicle to link our individual programs. It also provided our curriculum development

with direction. The cross-cutting themes helped us identify a content correlation which led to an essential question, and in turn, produced a connected curriculum. These cross-cutting themes can be used as a constant resource from which to draw future projects.

How can our process be helpful for designers of connected curriculum?

We began with an interdisciplinary perspective generated by our intersecting content-driven topics. We then focused ourselves more globally. During our early stages of development, we found the need for three components: a content map, cross-cutting themes, and a related essential question. Our introductory content map initiated discussions about each of our specific subject areas, providing an awareness of what others were doing in their classrooms. It also drove us toward identifying cross-cutting themes that could link areas of content. This global examination led us to a related essential question that broke down the content to fundamental concepts valued by all.

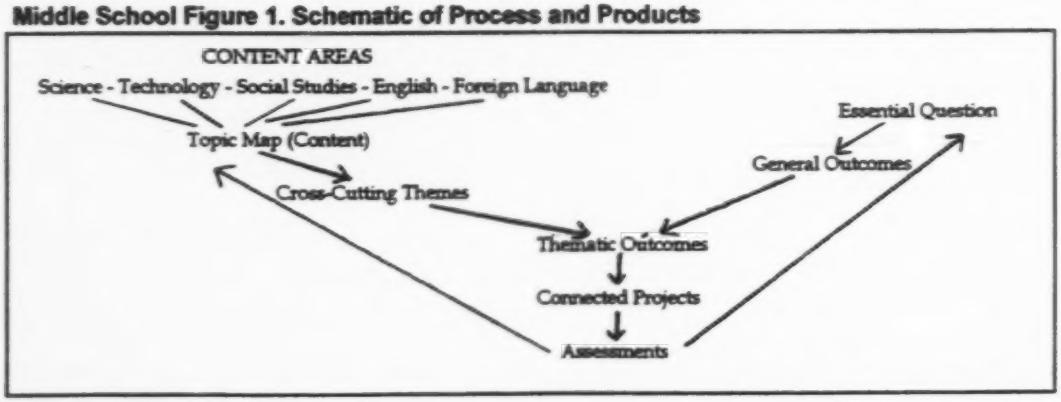
Literature suggests that a logical process begins with an essential question and moves to outcomes that foster connections and culminates with general assessments of those outcomes. However, we found that by working on our projects we were able to develop appropriate outcomes and assessments. Also, it is important that the group of teachers involved in the project be allowed to instruct the same group of students. This provides a consistent message resulting in a more powerful impact for the project and for the students.

What were the structure and products developed for our connected units?

In developing our connected units, we followed a process that began with the construction of a general outcome map. This map acted as a blueprint for each course of study. We plotted what was taught at any given time of the academic year in each specific content area. From here, we were able to identify related themes within each subject area. Once themes were noted, we created our essential question, general and thematic outcomes, and generic and project assessments (see Figure 1). Beginning with related themes allowed us to find the importance of content. Each teacher would be able to look at the bigger picture by focusing on content and similar themes.

It is also possible to begin this process with an essential question. However, this may diverge from straight content causing the need for the essential question to be modified. Structurally, both developmental processes are necessary to produce a curriculum of connection. Both processes value and apply the content of all involved disciplines thereby giving students a strong message of the purpose of the learning opportunity.

Middle School Figure 1. Schematic of Process and Products



What impact did this type of curriculum have on the participating schools?

Early on we discovered that most if not all of the subject areas represented on our team could find ownership within the overall project parameters. Disciplines that were not directly related to the subject areas addressed in our two curriculum units (see section on Project Description and Replication Plan below) could reinforce the essential question by bringing it to real-life situations. These courses offer the flexibility and opportunities for more students to "find a home" where they can become self-engaged while addressing the essential question. In one case, the essential question has applied outside of both of the Middle School projects stressing fundamental value and application of its message.

Moreover, and no less important, we became curriculum developers. Creation and control of our curricular path enabled us to experiment, invent, and collaborate. As creators of the project, its overall success was placed solely on our desks. We became the guides for the students to locate and comprehend the required connections and challenged them to develop their sense of awareness for others.

How was the design of curriculum and assessment changed?

Teachers usually go about the task of designing curriculum to suit the needs of their individual disciplines seeking to answer typical questions such as: How can I enable students to process the required elements of my course? How can I prepare student to take the next step? In designing a connected curriculum, teachers can examine the content of their course from the perspective of other fields – How can I express the content of my course through the knowledge gained from a different course? How can I move students to the next level by using other course content? Before CONNECTIONS, students often wanted to know why something specific to Science or Mathematics was being addressed in a Social Studies class. Now as a result of CONNECTIONS, students are developing an increased awareness of how a certain course will relate to other subject areas.

A connected curriculum produces a shift from required course quantity to one based on quality. Reinforcement of themes and outcomes from any number of separate subject areas results in assessments becoming quality oriented. This does not reduce so-called course load but yields a stronger understanding of fundamental concepts. More students become interested in the information to be understood and will engage in peer consultation, cultivating a learning environment where all students can attain mastery.

What would we recommend as a final word on writing a connected curriculum?

Less is more. Reflecting on fewer concepts will allow for heightened quality. If quality is established as the bottom line, more time will be spent on quality to ensure success. Required content quality can be achieved if course requisites are strengthened through a qualitative conceptual approach. If the connected curriculum is clearly directed, other subject areas will intensify and assist in the delivery of course content.

Curriculum Mapping

The development of the Middle School CONNECTIONS curriculum map evolved slowly over the three years of the project. The mapping process emerged in three stages, each stage paralleling a specific conception of curriculum design. Our first attempt at a map connecting curriculum used the subject-centered design used by the two schools at that time. Our second used the broad themes approach to curriculum design, and our third and final stage organized the curriculum around inquiry. In retrospect, after searching for rationales for each curriculum design, it appeared that three positions surfaced during the deliberations. The subject-centered approach reflected the notion that the purpose of education is to transmit knowledge; the use of broad themes supported the idea that

education requires an interaction between the learner and the subject matter; and the inquiry model, in very subtle ways, hinted at the potential transformative qualities of a connected curriculum. In still another way the three mappings revealed three different definitions of a connected curriculum—connection as interdisciplinary, connection as integration of subject matter, and connection as non-disciplinary or trans-disciplinary.

Stage One: The Subject-Centered Map

Using the definition of a curriculum map as a delineation of the course of study, each participant outlined his/her instructional program. These programs were outlined in terms of content, skills, and activities. This yielded several subject matter maps at both the seventh and eighth grade levels in both districts. Careful examination of the content revealed no strong connections from subject to subject; however, there were several skills and activities which were similar. This led to a search for things within each curriculum which could be interdisciplinary in nature; that is, things done in each course of study that also are done in other subjects while not necessarily being the same.

A major breakthrough came during a discussion of what each of us did during the first weeks of the school year. The common experiences were activities in which children learned about the resources, tools, and instruments to be used that year while studying the subject. It was important that these same tools and instruments were utilized and refined throughout the school year. Consequently, the first curriculum map to make connections for both teachers and students in all subjects was organized around the tools and instruments which humans use for maintenance and growth. This required no significant change in the curriculum maps being used at this time; therefore we did not develop a new map exclusively related to tools and instruments. However, this effort did lead to a new map developed during the second stage.

Stage Two: The Broad Themes Map

The success of the discussion about tools and instruments provided the catalyst for developing integrated maps—maps which showed additional ways in which the curriculum could be organized to connect knowledge and experiences. Very quickly the team developed four new maps (see Appendix 1, Maps A1-D2) for the following themes: *communication, energy, environment,* and *exploration.*

These maps demonstrated that when organizing curriculum around broad themes some connections could be made logically. What remained elusive, however, was how to make those connections explicit in ways which children could grasp psychologically. We also encountered familiar organizational barriers that exist within most middle schools such as tracking, scheduling of special subjects, and teaming in only the core subjects which made the implementation of an integrated curriculum more difficult.

Additionally, even when the connections were clear to team members, it was not clear what it was about the topics the students were to learn, especially those learnings which made connections to other experiences. Additional questions about the new curriculum had to be asked before the subject matter boundaries could be transcended, albeit somewhat blurred through integration. Those came in the next stage.

Stage Three: The Inquiry Map

The framing of an essential question made it possible for us to construct a curriculum map which went beyond the current curriculum yet drew heavily from it. The question posed is *"How do choices affect our boundaries?"* The result is a set of four curricula mapped according to a series of statements designed to answer the essential question. (See Appendix 1, Map E.) The series of statements were derived through the application of four outcome statements related to the goal, *"Students will expand his/her boundaries."* The outcome statements originally developed were: "Students will identify the boundaries"; "students will define the choices";

"students will show the relationship between choice and boundaries"; and "students will identify the most appropriate choice and support it." When we translated the generic curriculum into two instructional units focusing on the theme *exploration*, the essential question was modified slightly to reflect the particular definition given to the term "boundaries" by those teachers directly involved in the construction of the projects. It became *"How do choices we make expand or limit the parameters of a given situation?"* and *"How do you make the best choice in a given situation?"*

The outcome statements were also changed as follows:

1. Students will identify the parameters of a given situation. (Where are we now?)
2. Students will define the choices available in a given situation. (What are the available choices?)
3. Students will show relationships between available choices and boundaries. (How will each possible choice affect boundaries?)

Outcome four, "Students will identify the most appropriate choice and support it," was unchanged. The changes made in the essential question and outcome statements did not, however, require a change in the curriculum goal.

With the curriculum designed as a series of statements related to outcomes, it allowed the student to grasp the connections among the disciplines without disturbing other curricular outcomes unique to each discipline. The total educational process is connected by asking uniform questions throughout the school experience. It does not require teachers to necessarily share the same students nor plan the same experiences. It does, however, require that the school adopt the curriculum and diffuse it among all of the teachers. Our curriculum suggests an instructional program constructed around problem situations. Consequently, the series of questions implies an inquiry model of some sort, but at the same time it allows the arts, humanities, and sciences to define problems in their own ways. Most importantly for faculty development, the team saw in this new curriculum the potential for transforming both students and teachers.

Project Description and Replication Plan Part I: Eighth Grade Project

IROQUOIS SPACE ADMINISTRATION (ISA): MISSION CODE NAME *CONNECTIONS*

T minus 5 . . . 4 . . . 3 . . . 2 . . . 1 . . . liftoff. . . . We have liftoff . . . and Space Shuttle CONNECTIONS has cleared the tower.

STS-CONNECTIONS: Countdown to Lift-Off

Thus began the culminating activity of a six-week student learning opportunity that brought together students from the two partner school districts and united the disciplines of eighth grade Science, Social Studies, Math, and Technology Education.

The Middle School Team chose to divide into two grade level teams—seventh and eighth—to investigate our essential question and its relationship to the cross-cutting theme "exploration." The following section will describe the creation of one instructional unit—a simulated space shuttle mission control training and launch experience which helped students investigate the consequences of choices while emphasizing the cross-cutting theme of *exploration*.

The detail and design of the unit was inspired by the film *Apollo 13*. Students from both Philip Livingston Magnet Academy (Albany) and Iroquois Middle School (Niskayuna) watched this film which set the scene they would ultimately role-play. The students from Iroquois were informed that they had been selected to participate in the space shuttle mission *STS-CONNECTIONS*. They would begin a five-week training session during which they would gather information and gain experience. At the end of the training, they would assume the role

of mission control for an actual space shuttle launch, satellite retrieval, and landing. Students were then cycled through the following technical experiences:

Technical Experiences

Electricity/electronics experiences and topics included measuring amps, ohms, and volts, identification and function of electrical components, electron theory, and circuit troubleshooting.

Robotic arm system (RAS) activities included learning to manually operate as well as computer control a five-axis robot. A key element in this area was to gain proficiency in programmed control for a specific task with the least number of movements of the RAS.

Energy conversion technologies centered around the study of and experimentation with photovoltaic cells. Students needed to set up and measure the electrical output of these cells in several types of circuits.

Telecommunication experiences involved students in the gathering of information via Internet sites specific to space shuttle landing requirements as well as learning how to use a telecommunications package. This link provided a vital connection and enrichment to the overall activity.

Data analysis activities occurred when students were led through a chapter from their current math textbook which enabled them to interpret data collected in other portions of the training. Problems were built into the mission phase that required calculation and analysis to assist in decision making.

The above activities were overseen by Technology and Science teachers at Iroquois. Meanwhile, students at Philip Livingston were instructed that they would be responsible for "All Affairs," and would provide electronic communication to the ISA Mission Control in various roles including the Office of the President of the United States, the National Weather Service, the United States Department of State, and Interior Ministries of various island nations in the Pacific Ocean. It became the task of their Social Studies teacher to facilitate an understanding of the information provided and the authority exercised by each of these agencies. Philip Livingston students also created maps of fictitious island nations which would play a crucial role in the landing of the shuttle during the mission phase. These students learned to utilize the draw capabilities of the Clarisworks Software package to generate detailed maps to various scales for each of their islands. Specifications used to design an island suitable for space shuttle landing were obtained through on-line research. Students also were trained in using telecommunication packages to assist them in performing their role as communicators of "All Affairs."

As discussed in the previous section, four outcomes were developed to assess the essential question:

Outcome 1: Students will identify the parameters in a given situation.

Outcome 2: Students will define the choices available in a given situation.

Outcome 3: Students will show the relationship between available choices and boundaries.

Outcome 4: Students will identify the most appropriate choice and support it.

The general outcomes were rewritten to tie the essential question to the cross-cutting themes (see Appendix 1, Map E). Generic assessment tools were then developed which would enable teachers to evaluate student progress toward these outcomes in a wide variety of activities and disciplines described below. (See also the following section on Generic Assessment Tools and Rubrics and Appendices 7, 7A.)

Simulated Space Shuttle Mission: An Opportunity to Evaluate

The *CONNECTIONS* Space Shuttle Project was designed to provide opportunities to assess each of the outcomes. For example:

Outcome 1: In any problem encountered through exploration, students will define the type and scope of the problem and the pertinent factors related to it.

The five-week training phase was over, and students held their breath as *STS-CONNECTIONS* sat atop launch pad 2B at Kennedy Space Center. The classroom which served as the "space shuttle" was equipped with a simple RCA switch box enabling "astronauts" to send videotape images or live video feeds to "mission control." Using a simple system of two-way microphones, mission control could talk to the on-board crew (the Science teachers), and the crew could talk to the flight director and mission control (the teacher and students in Technology class). Using a script of a typical conversation between mission control and the shuttle, the launch was re-created on a giant screen television in a darkened mission control room and the mission was underway.

Within minutes the mission encountered its first problem. An on-board indicator light signaled that the cargo bay doors were not closed completely. Immediately the students responsible for *electricity/electronics* began gathering information. What type of circuit was involved? What was the sensory mechanism? What was the number of the circuit diagram? Could they get video of the circuit? How does the light sensor in the circuit assure that the doors will fully close? After defining the type and scope of the problem, students were ready to identify available choices, make decisions, and eventually solve the problem, as outlined by each of the subsequent outcomes.

Outcome 2: After defining the problem confronting an exploration, students will gather necessary resources and identify choices available in order to enable the exploration to proceed.

One day into the mission, mission control received word that an earthquake had made landing at Edward's Air Force Base impossible. Weather forecasts for the next 72 hours from the National Weather Service (students at Phillip Livingston) indicated that the alternate Cape Canaveral site was not an option for landing. Mission control was faced with the task of choosing a new landing site for the shuttle. Students in *telecommunications* were advised that an island in the Pacific Ocean would be an ideal alternate site, and they began an electronic dialogue with the State Department (students at Philip Livingston) about the three island nations that seemed to be the best possibilities. Students then gathered the information researched during the training phase regarding landing site specifications. Telecommunications "specialists" downloaded maps and data created by Philip Livingston students which detailed the physical layout and projected weather conditions of landing sites on each island. Electronic discussions were held with representatives of the island nations in an attempt to obtain additional data.

Throughout this process, students were being challenged to gather information on all possible landing sites in order to make the best choice. The remaining outcomes would be assessed as students argued for one site or another, evaluated options, and ultimately made a recommendation.

Outcome 3: For each possible choice available in an exploratory situation, the students will explain how that choice will affect the exploration and/or its outcomes.

One task of the mission was to retrieve a damaged satellite using the shuttle's robotic arm. *Robotic arm system technicians* in mission control were asked to guide astronauts in positioning the arm as the shuttle moved into orbit alongside the satellite. The satellite and arm could be seen on the large screen as it was fed to mission control by a live video remote. The controllers were put under a time constraint and instructed that they had one chance to successfully retrieve the multi-million

dollar satellite. There was little room for error. Students were faced with many choices related to the functioning of the robotic arm. They had an identical mock-up of the arm and satellite in the mission control room so they were able to experiment with the tricky approach to securing the satellite. Arguments broke out among students as to the most effective approach to each maneuver. Individuals were forced to predict the results of their proposals in an attempt to convince mission control that their advice should be relayed to the astronauts.

Outcome 4: After identifying the most appropriate choice, students will implement the choice and evaluate its influence on the exploration.

Whether the choice was related to the selection of a landing site, the drainage of power from a storage battery, the replacement of a faulty solar panel, positioning of the robotic arm, circuit troubleshooting, or repairing refrigeration coils, implementation of choices was essential and unavoidable. In every situation, decisions had to be made and implemented. Some choices had positive effects on the overall mission while others led to more problems. Students were asked to reflect on the overall influences of specific choices they made and whether, given the outcome, they would make the same choice again.

A Successful Mission

The Shuttle landed without incident on the South Pacific island of Ojuku. The mission was deemed successful—as the damaged satellite was retrieved, technical problems on board were solved, procedures for selecting alternate landing sites were successfully enacted, and valuable scientific data were collected in space. Through the theme of exploration and common content related to space flight, the disciplines of Science, Math, Social Studies, and Technology were connected through a unifying focus on analyzing choices and implementing decisions. This connected project met the needs of individual content areas as well as the New York State Standards for Math, Science, and Technology (see Appendix 2). More important, the project underscored the extent to which authentic tasks both engage and motivate learners.

Project Description and Replication Plan Part II: Seventh Grade Project

HUMAN BODY EXPLORATION

*You are invited to the **First Annual Iroquois Human Physiology Conference**. As a master scientist in the area of Human Physiology, you will be presenting a designed protocol in your area of expertise to other Iroquois Conference scholars and experts.*

This began the exploration into human physiology research and journal writing for the 764 section of students at Iroquois Middle School (Niskayuna). For the teacher developers, it was an exciting beginning to the connected project designed over a six-month period by middle school teachers from both partner school districts. The project design and implementation reflects the Middle School Team's essential question, outcome map, and problem-solving process.

The seventh grade CONNECTIONS project, "Exploration of the Human Body," focused on choice and the effects of choice on an individual or a group. In fact, this project was an exploration for us as curriculum designers and teachers.

Outcome 1: In any problem encountered through exploration, students will define the type and scope of the problem and the pertinent factors related to it.

We, the teachers, became the students designing a connected curriculum. We had to define the type and scope of the connected project and how this translated into student learning opportunities. We had to determine what pertinent factors were essential for students to discover where choices limit or expand boundaries. We decided that the type of

project we wished to design was a connected one where students would be able to see how a variety of choices can affect an outcome. The exploration of the human body afforded us this opportunity.

The three subject areas involved in this project—English, Science, and Social Studies—were united by the essential question, the common cross-cutting theme "exploration," and our four outcome statements (see Appendix 1, Map E). These components were used as guides to develop the exploration project and to direct student learning. The project would include research, problem solving, reflective writing, and oral presentation. We developed indicator statements directly related to the components of the "exploration" of the human body as an outgrowth of both the essential question and the outcome statements (see Figure 2). These indicator statements were later used to develop the assessment tools for each component of the project. (See section on Generic Assessment Tools and Rubrics and Appendices 8 and 8A.)

Before the exploration could begin, the Science, Social Studies, and English teachers needed to prepare the student participants with adequate information so they would be able to embark on this exploration; namely, to make an informed choice of what part of the human body to investigate. We recognized that this would be an important choice in limiting or expanding students' success, so we devoted three months to prepare for project implementation. (See Appendix 3 for a time frame for project implementation.)

Outcome 2: After defining the problem confronting an exploration, students will gather necessary resources and identify choices available in order to enable the exploration to proceed.

As we designed the project, we knew that we wanted a connected curriculum where students could see the relationship between choice and its effects on limiting or expanding boundaries. We needed to decide how this exploration should proceed and what resources we needed to accomplish this; in particular, what contributions were needed from each subject area.

Science classes would provide mostly content and an opportunity to develop and hone problem-solving skills. Students would choose a problem/disease to investigate in one of the systems of the human body, propose a "cure" for the problem or disease based on information gathered, make a model that was representative of some aspect of the student's problem or cure, and present the information and cure orally using tables, graphs, and the model. Students would discover that the choices they made when designing a cure for the disease could expand or limit an individual's physical boundaries. Their goal was to design a cure that was the least physically limiting. Our essential question was used to direct reflection and design of the cure. (See Appendix 4.)

Social Studies classes provided students with the tools necessary to collect data. Students were challenged to choose resources that expanded their knowledge on a subject. They were required to use four scientific research journal articles that could be accessed from the classroom Internet, CD-ROMs, or the Dynix System in our media center. These articles were used to research how the problem limits the functioning of the human body and what means are currently used by scientists to expand the boundaries imposed on the individual by this problem. (See Appendix 5.) Social Studies and Science teachers also worked together to inform students how governmental practices affect scientific investigation, particularly with respect to grant funding.

Middle School Figure 2. Indicator Statements for Each Outcome for the Human Body Exploration

ESSENTIAL QUESTION: How do the choices we make expand or limit our boundaries?

Outcome 1: In any problem encountered through exploration, students will define the type and scope of the problem and the pertinent factors related to it.

Indicator Statements

- Students will identify a problem/disorder/disease in a human body system.
- Students will explore the cause of the problem/disorder/disease in a human body.
- Students will articulate how the problem/disorder/disease in the body system affects the functioning of the human body.
- Students will explore and describe the biological boundaries impacting an individual with the problem/disorder/disease in a human body system.
- Students will explore the physical limitation imposed on a human with the problem/disorder/disease in a human body system.

Outcome 2: After defining the problem confronting an exploration, students will gather necessary resources and identify choices available in order to enable the exploration to proceed.

Indicator Statements

- Students will conduct research to explore and define the medical choices available to a person with the problem/disorder/disease.
- Students will use primary and secondary resources to explore information on the problem/disorder/disease in the human body.
- Students will use the Internet as a research tool to find information on the topic of the human body they are investigating.
- Students will determine what information they have already collected through research and what information is still needed during the course of investigation.

Outcome 3: For each possible choice available in an exploratory situation, the students will explain how that choice will affect the exploration and/or its outcomes.

Indicator Statements

- Students will design and create a visual and oral presentation to present cause/effect and strategies used to alleviate symptoms and a proposal for a cure for individuals suffering from the disorder.
- Students will demonstrate how the mechanism they design will be helpful for those who suffer from the disorder.
- Students will use journals to log why they are doing what they are doing. (Why did they choose the topic researched? Is the research working? What additional information is needed?) This focus is on the choices they are making in terms of research and how this is limiting or expanding their knowledge and search for a cure.
- If applicable to the topic, students will focus on how the choices an individual made in their lifestyle limited the functioning of the human body and created a boundary.

Outcome 4: After identifying the most appropriate choice, students will implement the choice and evaluate its influence on the exploration.

Indicator Statements

- Students will propose and/or design a "cure/assistance" program/protocol for an individual with the condition that was researched.
- Students will use the Internet as a tool to get reactions and information on project designs from experts.
- Students will use information from the "experts" and other research to support their cure choice.
- Students will write an evaluation of what they have learned and how they could have improved the project based on the choices they made in researching.

In English, students studied how journals have been used in the past by a number of writers. Students investigated the components needed to create a reflective journal. While students were exploring problems of the human body in Science class, time was reserved in English class to write reflective journal entries on the thinking process they were using during the investigation. Students were asked questions which are related to the essential question to guide them toward personal reflection or metacognition. (See Appendix 6.)

Outcome 3: For each possible choice available in an exploratory situation, the students will explain how that choice will affect the exploration and/or its outcomes.

This exploration was designed to be piloted in Iroquois Middle School and reflects input from each seventh grade teacher's content area represented on the CONNECTIONS team. This project could be modified to suit individual preference or content area constraints. The essential question, "How do the choices we make expand or limit our boundaries?" was

defined and used not only as a directive for students in each of the different subject areas, but for the teachers who designed this project in order to maximize our faculty resources. The choices we made expanded the amount we could accomplish with our group of seventh graders, but at the same time, it limited the amount of content that could be included from other academic subject areas.

Likewise, changes could be made in this project to meet the needs of different groups of students. A few suggestions or alternate approaches are discussed in the following paragraphs.

In Science, the essential question was used to direct student reflection and design of the cure. The main purpose of the cure was to expand the possibilities for people affected by the disorder being researched. Most of the cure designs demonstrate reflection on how a person's physical boundaries which are caused by a certain disease could be expanded to allow a person to live a more independent life.

The essential question could be interpreted in another way thereby shifting the focus. Not only could students use the question as a reflective guide when deciding on a cure, they could examine diseases of the human body that are caused and/or exacerbated by choices an individual makes over the course of a lifetime hence limiting the boundaries of independent life. For instance, teachers could suggest that students research diseases like arteriosclerosis and lung cancer paying special attention to how the choices to eat fatty foods or smoke/inhale tobacco products have affected health.

The reflective journal forced students to think about and explain their choices during this project. They compared the parameters of the proposed cure to a variety of resource components and discovered that choices made in scientific research require more than just an imaginative idea. Journal entries could be modified to focus students on other aspects of their learning as a result of the project. Although journals as a genre and the writing of reflective journals was the English component of our project, journal writing and its importance in history could be covered by the Social Studies teacher.

Our Social Studies component involved data collection, research, and writing in factual content. Reading comprehension and factual essays are not exclusive to a Social Studies curriculum and may be incorporated into an English class.

Outcome 4: After identifying the most appropriate choice, students will implement the choice and evaluate its influence on the exploration.

This was an exploration for both the teachers as the designers of the project and the students as the participants. For us, using Science content as the basis for the exploration and complementing this content with skills and information presentation from other subjects was the best choice to expand the educational limits of a non-connected classroom. If we were to repeat this project, the basic framework would remain similar, and any changes would be in the area of how questions are posed for the students to answer.

Generic Assessment Tools and Rubrics

Two methods were employed to determine student achievement. Evaluation of the *content* in the student learning opportunities was addressed through traditional methods. Assessing the quality level of student work with respect to the *general outcomes and subsequent essential question* required the development of generic holistic and analytical tools. These tools can be applied to all projects developed by the Middle School Team.

It must be noted that the rubrics included here represent a first revision after our initial pilot of the connected activities described in the previous sections and should be utilized as dynamic documents subject to continued refinement.

The *Holistic Assessment Tool* (see Appendix 7) is based upon the premise that if the general outcome statements are accepted as a total

process for problem solving, then an assessment tool that requires reflection on the validity of a decision made over other choices serves to unite the outcome elements for the purpose of assessing a student's ability to solve problems. Therefore, a "Best" rating is when a student or teacher would see the same decision made if confronted with the same situation again.

The *Analytic Assessment Tool* (see Appendix 8) serves to describe the quality of student work specific to each general outcome. Descriptors are written with key phrases and words that differentiate quality. For example, in Outcome 3 assessment cells for "Best" and "Good" note the use of "a broad vision" and "clearly ranked" versus "draw additional impacts through further reflection with some coaching."

As you review the previous section for connected learning opportunities, refer to the analytic and holistic rubrics used to assess student work quality.

Evaluation

The following section records comments and reflections on planning, instruction, and learning by each member of the Middle School Team when asked the question, *How has my teaching changed as a result of* CONNECTIONS*?*

I. Planning

Stephen: Planning has shifted from content-specific course work to process-oriented within a specific content, and eventually to process-oriented common to other disciplines.

Ed: Framing essential questions makes educational goals more immediate or apparent. Developing curriculum and long-range goals allow good decisions to be made.

Mary: Planning has shifted from being driven by content to more reflective in nature; now it is rooted in essential questions, cross-cutting themes, and outcomes developed around standing and newly developed essential questions. A broader scope is emphasized.

Jeanne: Goals are related to the content area curriculum and theme. Reading is used as a means to get information not as an isolated skill.

Julie: Focus includes goal-setting and student self-personalized activities to master content and to become a self-directed, efficient, and effective learner making connections between process and mastery.

Steve: Primarily, planning centered on a chronological presentation of curriculum. All planning now is reflective of the essential question based on choice and boundaries. The new "essential" planning provides more freedom to move around the subject matter and includes additional material from other courses of study. During our team prep period at Livingston (Albany), which meets three times a week, we discuss our required elements and attempt to reinforce all subject areas within each particular class. We take turns driving the content. This experience had heightened my awareness of my team members' course content at any time during the two-year middle school program at Livingston.

Patrick: Planning becomes easier because the connected curriculum approach allows for teachers to teach topics within their disciplines while emphasizing core questions and themes that stretch across curricula.

II. Instruction

Stephen: Developing a constant awareness to relate, draw out, model, and integrate the essential question in real time with students occurs daily.

Mary: The movement to connected instruction from interdisciplinary has been facilitated by the reflective planning. Common themes create consistency across subject area barriers. This type of instruction provides a springboard for faculty curricular discussion and common planning with parameters valued by all involved educators.

Jeanne: Reading strategies used in content area classes are not just a tool to explore literature.

Julie: Focus includes mastery of the goal-setting and goal-achievement process and the connections between the two in order to master content and take charge of the learning process.

Steve: The teaching of middle school Social Studies is based on chronological survey of cause and effect. Important to the curriculum is how one event relates to past and future events. The choices have been made, resulting in predictable effects. These effects then lead to the cause of the next event. By expanding or limiting the choices and boundaries of any given event, students begin to examine course content differently. Instead of following chronological order of cause-effect based on choice, I could reverse the scheme and teach how different effects could change earlier choices. This "what if . . ." approach opens a new understanding of content for the students. Given the boundary (the effect), students could decide how certain choices (the causes) would change the actual event being studied.

Patrick: A connected curriculum is different from an interdisciplinary project. The interdisciplinary approach selects one topic and views it through the eyes of different disciplines. A connected curriculum identifies questions or broad themes and reinforces them through a variety of very different topics.

III. Learning

Stephen: Student assessment methods have been altered from the degree of meeting a ranked set of requirements to a set of quality descriptors defining what "Best," "Good," "Satisfactory," and "Minimally Acceptable" look like to a student.

Mary: Students can see the connections and relationships between different content areas. The lines that separate subjects are becoming blurred; students see where and how they are related. Content and skills are not taught in isolation. Problems are solved in different disciplines using consistent methods and skills.

Jeanne: Students enjoy reading and see it as a process for gaining information. They self-evaluate and can choose materials appropriate for their level. Reading is no longer considered an activity which emphasizes "saying the words right." Students employ strategies in content area classes.

Julie: With this personalized and then formalized process with a focus on options and choices leading to achievement of an ultimate goal, the student is intensely involved and self-directed in learning and able to make adjustments in his/her approach to mastery.

Steve: Students clearly are more involved in their own learning. Student generated rubrics provided ownership in projects and allowed students to see what goals were necessary for successful completion. Their interest in the subject matter increased, directly affecting student behavior and overall attitude. As students began to see connections with other courses of study, their anticipation heightened. Students wanted and demanded to know how a teacher would connect his/her curriculum to one or more of their course of study. This produced greater interest not only in Social Studies but in all other academic subjects. Greater interest led to higher achievement.

Patrick: Students invest more true effort and enthusiasm when they see a practical or authentic application of material being presented. Because real life is connected, it is logical that material presented in a connected fashion will lead to this elevation in effort which will ultimately result in higher student learning.

Appendices

CONNECTIONS Middle School Appendix 1. Curriculum Maps
Curriculum Map A1
TOPIC: Communication
GRADE LEVEL: Seven

Content by Topic Category

SUBJECT AREA	Researching/Data Collecting	Telecommunication	Reporting of Data
English	• Process writing • Portfolio assessment • Book reviews • Computer databases	• Oral reports through video presentations; individual and group	• Process writing • Technical writing
Science	• Technical reading • Use of the Internet as a research tool • Methodology of collecting scientific data	• Telecommunication as a tool for research and communication	• Reporting data in tables, graphs, and charts
Technology	• All course work involves gathering pertinent information using appropriate methods	• Telecommunication is considered an instructional technology and is utilized as appropriate	• All course problems involve the presentation of information using appropriate methods
Social Studies	• Computer-based research (Encarta, Grolier, Internet, U.S. Atlas) • Portfolios • Essays • Battle enactment • Boston Massacre enactment	• Telegraph development • Industrial Revolution • Telephone	• Maps • Charts • Graphs

CONNECTIONS Middle School Appendix 1. Curriculum Maps
Curriculum Map A2
TOPIC: Communication
GRADE LEVEL: Eight

Content by Topic Category

SUBJECT AREA	History and Communication	Scientific Communication	Telecommunication	Oral and Written Communication
English	• Novel reading	• Scientific approach to vocabulary, analyze literature and poems (problem → predict → justify → "make sense")	• Technical reading • How to get information from the Internet	• *Going Home*, Puerto Rico
Science	• Role of communication in the development of modern atomic theory	• Metric System as a tool of scientific communication • Organization of a scientific paper	• Use of telecommunication in advancing scientific research • Enhancing communication through light and sound	• Debate as a way of advancing scientific ideas
Technology	• All course work involves gathering pertinent information using appropriate methods	• Scientific communication is utilized as a method of understanding system variables and constants	• Telecommunication is considered an instructional technology and is utilized as appropriate	• All course work involves the presentation of information using appropriate methods
Social Studies	• Age of Invention: Rise of industry, Technological Age (fiber optics, computer age, advances in communications)	• Age of Invention: Rise of industry, Technological Age (fiber optics, computer age, advances in communications)	• Use of telecommunication as a resource and communication tool to distant areas (areas outside the classroom)	• Used to assess student understanding • Investigate how changes in oral and written communication influence cultures and change

CONNECTIONS Middle School Appendix 1. Curriculum Maps
Curriculum Map B1
TOPIC: Energy
GRADE LEVEL: Seven

Content by Topic Category

SUBJECT AREA	Industrial Revolution	Literature and Energy	Magnetism	Energy in Living Systems
English	• Historical fiction • Note taking • Expository writing	• Theme development • Gender issues • Child labor laws • North vs. South issues	• Reading and writing related to the technical uses of magnetism today	• Biological reading • Poetry writing related to photosynthesis • The "sun" as a theme in writing
Science	• Diseases of a time period • Effects on today's health	• Writing limericks, poetry, and prose related to the concept of photosynthesis	• Places where magnets are used in science • Principle of magnetism	• Photosynthesis • Food chains/webs • Cellular respiration
Technology	• Energy conversion devices • Gravitational energy: water wheels → saw mills (mechanical energy) • Chemical energy converters (steam engines → mechanical energy from chemical energy)	• Various written, computer, and video references to accompany course problems	• Magnetically levitated vehicles as a critical element in future transportation systems	• Artificial body parts • Chemical energy conversion within body for energy • Methods of hydroponics and tissue culturing of plant cells
Social Studies	• Factory systems • Assembly lines • Steam, coal, oil • Electricity development	• Historical perspectives of the effects of different energy types on a culture • Nuclear energy debate	• Compass • Age of discovery • Exploration	• Environmental issues • Medical advances • Space energy • EPA • Conservationism • Ozone depletion • Global warming

CONNECTIONS Middle School Appendix 1. Curriculum Maps
Curriculum Map B2
TOPIC: Energy
GRADE LEVEL: Eight

Content by Topic Category

SUBJECT AREA	Solar Energy	Alternate Sources	Literature	Space and Nuclear Age	Chemistry
English	• Technical reading and writing on energy conversions	• Current literature on alternate energy sources	• Data interpretation • Societal implications • Creating a model (reading directions) • Moral issues/ decisions	• Historical and technical reading related to the nuclear age • Science fiction	• Technical reading
Science	• Major energy sources	• Storing energy in chemical bonds • Fractional distillation	• Data interpretation • Societal implications • Creating a model (reading directions) • Moral issues/ decisions	• Pros and cons of nuclear energy	• Chemical reactions
Technology	• Passive and active solar systems as alternate energy sources	• Photovoltaic energy conversion devices • Nuclear vs. non-nuclear energy alternatives	• Various written, computer, and video references to accompany course problems	• Emerging technology • Impact on personal and societal level • Debates: nuclear vs. non-nuclear • "NIMBY" syndrome vs. positive impacts on society	• Lighting related to the action of chemicals or chemical reactions • Phosphorescing elements controlled in lighting devices • Amusement park light sticks
Social Studies	• Impact of solar energy on the economy and industry	• Industrial Revolution (coal, steam, electric, solar, wind, nuclear development)	• Societal implications • Moral issues/ decisions	• Orbit moon, unmanned and shuttle programs • Cause/effect • Space race • Nuclear weapons • Restriction agreements • Super powers	• History of scientific investigation in chemistry and the effects on a culture

CONNECTIONS Middle School Appendix 1. Curriculum Maps
Curriculum Map C1
TOPIC: Environment
GRADE LEVEL: Seven

Content by Topic Category

SUBJECT AREA	Habitat Classification	Development of Technology	Map Reading and Making	Literature/Environment	Music of Nature
English	• *Children of the River*, Cambodia • *Kim/Kim*, Japan • *A Taste of Salt*, Haiti • *Going Home*, Puerto Rico	• Use of word processing • Internet communication • Encarta (research) • Graphic design • Creating a catalog of games	• How to read maps • The language of map making and reading	• Urban, rural, and suburban literature • Socioeconomic status	• Listening to music for synopsis stimulation (Mozart phenomenon)
Science	• Classification of 4 habitats (herb, shrub, wetland, climax) - Animal population - Plant populations - Humidity, soil moisture, soil content, soil pH, water pH	• The microscope as a scientific tool and how it has changed over time • Medical treatment over time as it relates to changing technology	• Base map of wetland area • Topographic maps	• Poetry of the environment • How does the environment inspire us?	• Sound waves and the varied effects on the tympanic membrane • Music's effect on the ear and the neurological outcome
Technology	• Fresh Water Wetland Act • Definition of legal vs. ecological • Classification of wetlands (I, II, III, IV) • Standards for permit issuance	• Environmental control technologies - Auto-emission devices - Air-cleaning devices - Water testing and purification	• Base map of wetland area • Topographic maps • Magnetic levitation transportation systems locations	• Technical reading on the environmental issue of the day (e.g., wetlands) • Technical literature--traditional or electronic to support information gathering	• Sound-monitoring devices - How they work? - Their purpose
Social Studies	• Geographic and topographic features and regions of North America • Native American cultural areas	• Tools of exploration: compass, astrolabe, sextant • Weapons of revolution • The Industrial Revolution • American Revolution	• Different types of maps • Map symbols • Latitude and longitude • Drawing maps (actual and mythical)	• Iroquois creation song; "Story of the Peacemaker" • Cause/effect • Space race • Nuclear weapons • Restriction agreements • Super powers	• History of sonar use by the government, armed forces, and medical fields

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CONNECTIONS Middle School Appendix 1. Curriculum Maps
Curriculum Map C2
TOPIC: Environment
GRADE LEVEL: Eight

Content by Topic Category

SUBJECT AREA	Migration	Environmental Impact	Literature	Beauty and Structure
English	• *Children of the River*, Refugees • *Lyddie*, Irish famine	• *Roll of Thunder, Hear My Cry*, United States • *Lyddie*, Ireland	• *Roll of Thunder, Hear My Cry*, United States	• *Going Home*, Puerto Rico
Science	• Effects of climate on animal migration	• Using chemistry and physics to solve problems in local surroundings	• Technical reading on the environmental issue of the day	• Classification of matter within local areas • Atomic theory--building blocks of local area matter
Technology	• Historically, early technologies that facilitated migration (e.g., steam engine, rail system)	• Study and experimentation with alternate energy sources (e.g., electricity generation through solar, photovoltaics, wind vs. fossil fuels)	• Technical reading on the environmental issue of the day • Technical literature--traditional or electronic to support information gathering	• Architectural design in concert with ecosystems
Social Studies	• Settling frontiers - Growth of railroads - Age of immigration - Growth of cities	• Growth of business • World War I and II • Pollution • Depression	• Government model to debate issues of the environment	• Historical changes in architecture and industry and the effects on the environment

CONNECTIONS Middle School Appendix 1. Curriculum Maps
Curriculum Map D1
TOPIC: Exploration
GRADE LEVEL: Seven

Content by Topic Category

SUBJECT AREA	Travel Logs	Taxonomic Keys	Telecommunication	Literature	On Being Human
English	• Strategies for reading comprehension • Journals (writing and reading)	• Process reading • Gathering information	• Internet as a resource	• Genre studies (e.g., biography, autobiography, historical fiction)	• Emotions, poetry, rap, lyrics, documentary • Theme, "My unique qualities" • Cooperative grouping • Reflective journal writing
Science	• Use of travel logs as primary research to draw conclusions and formulate hypotheses	• Identification of organisms • Student construction of a key • Effects of immigrant species on native population	• E-mail and Internet as a resource for research and communication	• Technical reading	• Human body systems
Technology	• Computers • Image scanners • Photographic process as tools for advertising	• Material science • Advances as a result of categorization of material types	• Telecommunication is considered and utilized as appropriate--information, dissemination	• Technical literature--traditional or electronic to support information gathering	• All tech activities related to increased awareness of personal choice and its impact on performance
Social Studies	• Logs/diaries--Columbus, Oregon Trail, Anne Frank, The Mayflower	• Returning of plants and animals to Europe after exploration • Effects of immigrant species on native population	• Telegraph development • Industrial Revolution • Telephone	• Logs/diaries--Columbus, Oregon Trail, Anne Frank, The Mayflower • Primary documents of explorers in any time period	• Effects of exploration • Research skills

CONNECTIONS Middle School Appendix 1. Curriculum Maps
Curriculum Map D2
TOPIC: Exploration
GRADE LEVEL: Eight

Content by Topic Category

SUBJECT AREA	NASA Space Link	Scientific Research	Expansion	Transportation	On Being Human
English	• Strategies for reading fiction • Expository writing	• Graphic organizers • Editing and revising • Presentation of data--oral, written, computer	• Literature on western expansion • Literature of space travel • Written communication	• Travel logs • Technical reading • Literature on transportation	• Emotions, poetry, rap, lyrics, documentary • Theme, "My unique qualities" • Cooperative grouping
Science	• Aiding space exploration through advances in physics and chemistry	• History of understanding the atom • Independent research	• Effects of expansion on science	• Transportation vehicles • The reactions of combustion	• Nature of humanity and the power of science • Effects of science on the human condition
Technology	• Electricity and electronics • Robotics • Energy conversion process (photovoltaics)	• Photovoltaic energy conversion devices • nuclear vs. non-nuclear; energy vs. alternative energy	• Expansion hinges on technical advances (e.g., satellite technology, telescope, microscope)	• Future trends • Electric vehicles • Mag/Lev systems • Personal rapid transportation systems • Transport beyond atmosphere	• All tech activities related to increased awareness of personal choice and its impact on performance
Social Studies	• Space exploration programs	• Trends in scientific research • Effects of research on a culture	• Settling the frontier • Issues with Plains Indians • Expansion overseas--The Pacific, Latin America	• Wagon trains • Railroads • Automobiles • Refrigerated trucking • Space modules • Space shuttles	• Effects of exploration and expansion on native cultures

CONNECTIONS Middle School Appendix 1. Curriculum Maps
Curriculum Map E
Outcomes Curriculum Map

Essential Question: How do the choices expand or limit parameters of a given situation?

General Outcomes

***Outcome 1*:** Students will identify the parameters in a given situation.
***Outcome 2*:** Students will define the choices available in a given situation.
***Outcome 3*:** Students will show the relationship between available choices and boundaries.
***Outcome 4*:** Students will identify the most appropriate choice and support it.

Outcomes by Theme

	Communication	Energy	Environment	Exploration
Outcome 1	When examining communication from a variety of fields, students will identify the symbol system used, the structure of the message, the method of transmission, and its entered or observed input on the audience.	In any situation in which energy is being consumed or is to be expended, students will identify the energy source and the "work" being done.	When examining any environmental situation, students will identify the nature of the environment and the relative variables involved.	In any problem encountered through exploration, students will define the type and scope of the problem and the pertinent factors related to it.
Outcome 2	Given the time, place, purpose, and importance of a communication, students will identify the choices available for structuring the message and selecting media, using different symbol systems and reaching audiences.	Given situations in which more than one type or amount of energy could be used, students will identify the energy choice available and the amount of each "fuel" needed to accomplish the task.	When any environment has been defined and its parameters described, students will define the choices which can be made which may have an impact on that environment.	After defining the problem confronting an exploration, students will gather necessary resources and identify choices available in order to enable the exploration to proceed.
Outcome 3	Students will demonstrate and/or explain how the choices made regarding communication systems either enlarge or diminish the impact of the message.	Students will show the relationship between the type and/or amount of energy being used and the change in the input and output variables.	For each choice which can be made in an environmental situation, students will explain how that choice affects the environment.	For each possible choice available in an exploratory situation, students will explain how that choice will affect the exploration and/or its outcomes.
Outcome 4	Students will develop a communication in a variety of systems, analyze those of others, and explain why the choices made in structuring the communication system was or was not the most appropriate under the circumstances provided.	When making a choice in situations requiring the use of energy, students will explain why that choice is the most appropriate.	When making a choice having an environmental impact, students will explain why that choice was the most appropriate in terms of all the variables involved.	After identifying the most appropriate choice, students will implement the choice and evaluate its influence on the exploration.

CONNECTIONS Middle School Appendix 2
Eighth Grade Project: Iroquois Space Administration

General Outcomes Keyed to New York State Standards for Math, Science, and Technology (MST)

Outcome 1: Students will identify the parameters in a given situation.

MST 1 • Students will use mathematical analysis, scientific inquiry, and engineering design, as appropriate, to pose questions, seek answers, and develop solutions.

Outcome 2: Students will define the choices available in a given situation.

MST 2 • Students will access, generate, process, and transfer information using appropriate technologies.

Outcome 3: Students will show relationships between choices and boundaries.

MST 3 • Students will understand mathematics and become mathematically confident by communicating and reasoning mathematically, by applying mathematics in real-world settings, and by solving problems through the integrated study of number systems, geometry, algebra, data analysis, probability, and trigonometry.

MST 4 • Students will understand and apply scientific concepts, principles, and theories pertaining to the physical setting and living environment and recognize the historical development of ideas in science.

MST 5 • Students will apply technological knowledge and skills to design, construct, use, and evaluate products and systems to satisfy human and environmental needs.

MST 6 • Students will understand the relationships and common themes that connect mathematics, science, and technology and apply the themes to these and other areas of learning.

MST 7 • Students will apply the knowledge and thinking skills of mathematics, science, and technology to address real-life problems and make informed decisions.

Outcome 4: Identify most appropriate choice and support it.

MST 3 • Students will understand mathematics and become mathematically confident by communicating and reasoning mathematically, by applying mathematics in real-world settings, and by solving problems through the integrated study of number systems, geometry, algebra, data analysis, probability, and trigonometry.

MST 4 • Students will understand and apply scientific concepts, principles, and theories pertaining to the physical setting and living environment and recognize the historical development of ideas in science.

MST 5 • Students will apply technological knowledge and skills to design, construct, use, and evaluate systems to satisfy human and environmental needs.

CONNECTIONS Middle School Appendix 3
Seventh Grade Project: Human Body Exploration

Time Frame for Implementation

December 1995
Middle School CONNECTIONS Team members divided into groups by subject area.

Essential question, outcomes, and indicator statements developed and refined with help of an outside consultant.

Project draft and discipline-specific roles are defined.

December 1995 - February 1996
Seventh grade CONNECTIONS sub-team worked on developing student learning opportunities and assessments that reflected indicator statements.

- Human Body project guidelines were refined.
- Reflective journal entries were written and revised by instructors. The goal of the entries was for students to demonstrate metacognition (thinking about thinking).
- A pool of reading comprehension strategies, research format, and question/problem statements to guide research was developed.
- Rubrics were written to define criteria for each area that would be assessed in project. (We discovered that these would be refined continually.)

March 1996 - April 1996
Students were being prepared in each discipline for the work that needed to be accomplished for the project.

Science

- Studied each system of the human body.
- Read articles from scientific journals on disorders in specific body systems. Questions related to articles were answered and class discussions on different disorders occurred.
- Debated different sides of issues related to public health. (E.g., artificial hearts vs. heart transplants; which is "better" and which should receive government funding for research?)
- Viewed documentaries and medical trade videos related to innovative medical treatments for certain human body disorders. Used videos as additional informational resources.

English

- Read and analyzed journals as a genre.
- Reviewed samples of journals from a number of different people (e.g., Einstein's journal, Edison's notes for General Electric).

Social Studies

- Used a variety of historic resources to practice using research techniques and tools.
- Developed note-taking skills and writing style specific to compiling factual information.
- Related the town meeting style of government of early Americans to the legislative policy debates of present.
- Researched public health policy and the procedure for obtaining legislative funding and related this to the artificial heart/heart transplant debate in Science.

May 1996

Week One

- Students chose topic to be researched.
- Students completed journal entry question number one for the reflective journal in English class. (See Appendix 6 for a list of journal entry questions.)
- Began research on topic in Social Studies. Four articles were due by Friday of first week.

Week Two

- Note taking on article.
- Journal entry question two in English.
- By week's end, research on topic completed, notes checked by Science and Social Studies teacher, proposal for both "cure" and model to Science teacher.

Week Three

- Journal entry questions three through six in English.
- Final revised notes due to teachers.
- Began oral report organization.
- Telecommunication to experts explaining purpose of project and proposal of a cure began for students. Any information received needed to be incorporated into proposal to make it more viable.

Week Four

- Journal entry questions seven through ten in English.
- By week's end, student's final journal submitted.
- Oral report submitted and revised according to adult feedback.
- Students prepared for presentation.
- Revised 3-D model plan/design and product due by end of the week.

CONNECTIONS Middle School Appendix 4
Seventh Grade Project: Human Body Exploration

The Human Body Final Project

Your presentation is on _____.

The requirements are:

1. Choose a system of the human body. This can include the circulatory, digestive, immune, respiratory, nervous, or skeletal/muscular. Choose a topic concerning the chosen system. For example, if you choose the circulatory system you may want to investigate coronary artery disease.

2. Choose five key words and their definitions from the system that you investigate. These five definitions must be different from the vocabulary words that we defined already for each unit. This should be done on looseleaf paper in pen and in complete sentences. Failure to follow these directions is unacceptable and will be returned for revision.

3. Posters or other visual effects should be created to illustrate your topic. Other visuals could include HyperCard documents, games, or models. For example, if you choose coronary artery disease, you could make a model of an artery and what it looks like at different stages of coronary artery disease. There are some examples located in the front of the room.

4. Along with each project should be a written description of what the poster or visual is trying to tell your audience. For example, the visual of coronary artery disease could include descriptions of each stage and the kind of eating and exercise behavior that causes this to happen.

5. The fourth part of the project will be an oral report (2-4 minutes) explaining your subject. This should include the subject and how it affects the human body, a description of your poster or visual, and why you chose this topic for study.

Good Luck!

CONNECTIONS Middle School Appendix 5
Seventh Grade Project: Human Body Exploration

Social Studies Component: Research Questions

1. What is the normal functioning of the system/organ/body you are investigating?

2. How do you get the disease? What is the cause?

3. What part of the body is affected?

4. What are the symptoms?

5. How is the affected person limited?

6. What boundaries does this problem impose on a person?

7. How is the disease treated?

8. Are there choices that a person made during their life that contributed to or increased the intensity of this disease?

9. How do current treatments help to expand the boundaries set by the disease?

10. What choices could you make to expand the boundaries set by the disease?

CONNECTIONS Middle School Appendix 6
Seventh Grade Project: Human Body Exploration

English Component: Journal Entry Questions for Reflective Journal

1. Why did I choose this topic?

2. What is linking? (Reflect on your experiences this week with Dynix, the Internet, and the media computer.) How did linking help me research my topic? When I am making decisions in my own life, do I link my thoughts? If I do, how do I do this?

3. How does the problem I have chosen to research limit people who have it?

4. What did I learn about my topic/problem so far in my research? How can I use this information to direct me to an oral report, a 3-D model, and a "cure"? What direction does this lead me?

5. What is the hypothesis for a cure I have derived? What have I observed/researched to bring me to this hypothesis? How has the scientist that I have contacted helped me with my hypothesis?

6. How will my cure help to expand the boundaries of an individual with this disease/problem?

7. What are the positive parts of my cure? What parts do I still need to investigate? How could I help someone with this disease examine the choices?

8. "Success is 1% inspiration and 99% perspiration."

   What does this mean to me? How does this relate to the research I have done on my project and cure?

9. What did I learn about scientific research/presentation from this project?

10. Based on the information gathered, choices available, and the impact of my choice of a cure on an individual with the disease I am researching, would I make the same decision again, alter my decision, or drastically change my decision? In what ways would I alter or change my decision?

Holistic Assessment Tool for General Outcomes

Best	Alter	Change
Based upon the information gathered, choices available, and the impact of the choice on the surroundings, I would ***make the same*** decision if presented with the same situation again.	Based upon the information gathered, choices available, and the impact of the choice on the surroundings, I would ***alter*** my decision to better satisfy the situation.	Based upon the information gathered, choices available, and the impact of the choice on the surroundings, I would ***change*** my decision to satisfy the situation.
	Evaluate your decision: This is why/how I would ***alter*** my decision:	**Evaluate your decision:** This is why/how I would ***change*** my decision:
Teacher Comments	**Teacher Comments**	**Teacher Comments**

Applying the Holistic Assessment Tool to the Iroquois Space Administration Project

Space Mission Project

Editor's Note: This holistic assessment tool was used at the end of each week of the training phase to allow students to sharpen their awareness of the essential question as well as the pervasive nature of its message.

Training Phase Reflection **Week # 1 2 3 4 5**

1. Identify the choices available with respect to a major decision made during the week?

_____
_____
_____
_____
_____

2. What factors regarding the choices did you consider before making the decision?

_____
_____
_____
_____

Evaluate Your Decision

Best: I would make the same decision again given the same situation.

Alter: I would alter/modify my decision based upon the following reasons:

_____
_____
_____
_____

Change: I would completely change my decision because I neglected to consider the following:

_____
_____
_____
_____

Teacher Comments

_____
_____
_____
_____

Analytic Assessment Tools for General Outcomes

	Outcome 1 identification of parameters	Outcome 2 definition of choices	Outcome 3 showing relations/impacts	Outcome 4 justification of decision
Best	Any reader or observer can easily follow the trail of identifying parameters related to a situation.	All choices are clearly identified, understood, and highly organized.	The problem solver has a broad vision of potential impacts which allows choices to be clearly ranked.	Supporting details are logical, convincing, and organized.
Good	A reader or observer must make minor clarifications or reflection to follow the identification of the situation parameters.	All viable choices are identified and understood with minor questioning or reflection.	The problem solver is able to draw additional impacts through further reflection with some coaching.	Supporting details become viable with questions and dialogue.
Satisfactory	A reader or observer must "talk through" or ask questions to draw out a situation parameters.	Additional effort is necessary to locate and more fully understand and discriminate between choices.	The problem solver identifies typical, potential impacts.	Supporting details are outlined and must be "talked through" for understanding and clarification.
Minimally Acceptable	A reader or observer recognizes gaps in a complete listing of parameters.	All viable choices are not completely understood due in part to a lack of organization and subsequent confusion.	The problem solver requires significant coaching to draw relationships between choices and subsequent rankings.	Supporting details require effort to reorganize and rethink in order to begin making a case for a decision.

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Applying the Analytic Assessment Tool to the Human Body Exploration Project

Human Body Project: Oral Presentation and Model	
Best	Presentation contains a clear explanation of the cause, effect, and current medical practices that can be clearly followed by the observer. Three-dimensional model is incorporated into presentation and demonstrates originality. Explanation of cure choices are clearly identified, understood, and highly organized. Cure choice chosen by student is clearly detailed and demonstrates broad vision of potential impacts on patient. Cure choice is supported with details that are logical, convincing, organized, and original.
Good	Presentation contains an explanation of the cause, effect, and current medical practices that can be followed by the observer after minor clarification. Three-dimensional model is incorporated into presentation. Explanation of cure choices are identified, understood, and organized better with some dialogue with teacher. Cure choice chosen by student is detailed and impacts on patient are more complete after additional reflection. Cure choice is supported with details that are logical, convincing, and organized. Choices and supporting details are strengthened, clarified, and justified after additional dialogue with teacher.
Satisfactory	Presentation contains an explanation of the cause, effect, and current medical practices that can be followed by the observer after asking questions to draw out situation parameters. Three-dimensional model is incorporated into presentation and demonstrates a typical impact on patient. Explanation of cure choices are outlined and must be talked through for understanding and clarification. Cure choice chosen by student needs additional effort to fully understand and discriminate from other choices. Cure choice is outlined and needs further clarification.
Minimally Acceptable	Presentation contains gaps in the explanation of the cause, effect, and current medical practices presented to observer. Three-dimensional model is incorporated into presentation and is representative of research. Explanation of cure choices are identified but need further organization to more fully understand and discriminate. Cure choice chosen by student needs additional effort and coaching from teacher. Cure choices need reorganizing and rethinking in order to allow student to make a decision.

Applying the Analytic Assessment Tool to the Human Body Exploration Project

Human Body Project: Reflective Journal	
Best	Entries articulate understanding of problem and choices as research progresses. Additional effort is necessary to locate and more fully understand choices. Choices are evaluated and ranked using broad vision of potential impacts. Supporting details are logical, convincing, and organized.
Good	Entries articulate growth as research progresses. All viable choices are identified and understood with minor questioning or reflection. Choices made in research with minor refinements and coaching are clear, evaluated, and ranked. Supporting details become viable with teacher questioning and dialogue.
Satisfactory	Entries articulate understanding of problem and choices as research progresses. Additional effort is necessary to locate and more fully understand choices. Choices are evaluated and ranked using typical or potential impacts. Supporting details are outlined but need teacher questioning and dialogue to complete.
Minimally Acceptable	Significant coaching is required to draw relationship between choice and boundary. Supporting details require reorganization and rethinking to demonstrate understanding. Choices could be better articulated with increased organization.